50.(New) Detector of claim 27, further comprising a conductive coating on said scintillator configured to reflect photons generated therein.

51.(New) Detector of claim 50, wherein the conductive coating on said scintillator is selected from the group consisting of aluminum, chrome and combinations thereof.

REMARKS

By the foregoing amendments, Claims 1-6, 8, 10, and 13-15 have been amended, Claims 18 and 19 are canceled, Claims 11 and 12 are withdrawn from further consideration, and new Claims 28-51 have been added. No new matter is added by any of the amendments to the original claims by the new claims.

In the Official Action, the Examiner rejected Claims 1-10 and 13-24, but indicated that Claims 25, 26, and 27 were allowable. New Claims 28-35 depend from Claim 25 either directly or indirectly and therefore, are allowable for at least the same reasons as Claim 25. New Claims 36-44 depend from Claim 26 either directly or indirectly and therefore, are allowable for at least the same reasons as Claim 26. New Claims 45-51 depend from Claim 27 either directly or indirectly and therefore, are allowable for at least the same reasons as Claim 27.

The Applicants respectfully request that the Examiner reconsider the rejection of Claims 1-10, 13-17, and 20-24 in the light of the foregoing amendments and the following remarks.

35 USC 102(b): Claims 1, 5, 6, 13, 14, and 17

The Examiner rejected Claims 1, 5, 6, 13, 14, and 17 under 35 USC 102(b) as being anticipated by the apparatus described and shown in U.S. Patent No. 5,969,361 (Blavette). It is believed that the subject matter of Claim 1, as now presented, is novel relative to the apparatus of Blavette for the following reasons.

Blavette describes a device that appears to be designed to simultaneously

provide arrival timing information and a positional image of charged particles. To that end, the Blavette device incorporates microchannel plates, a phosphorescent layer for converting electrons to photons, and an CCD imaging device.

In the operation of the Blavette device, charged particles stimulate the release of electrons from an electron multiplier having two or more cascaded microchannel plates. The resultant cluster of electrons is then detected by a plurality of anodes (producing the time of flight information) and passed through the phosphorescent layer to produce a light pulse that is subsequently imaged by the CCD device.

The arrival time of a charged particle is determined when the electrons produced by the microchannel plates are subsequently collected on the anodic conductors. The anodes grid (14) of the Blavette device collects the electrons from the electron multiplier (4) and outputs a signal that is indicative of the impact moment of the charged particles. This is the conventional method used in nearly all current time-of-flight mass spectrometers. Thus, the Blavette device insofar as it relates to time-of-flight mass spectrometry, describes only a conventional arrangement. Indeed Blavette confirms that assertion where it states in column 6, lines 40-43 ". . . in this detector, the position of an impact is given by a light spot *and the time of flight measurement is conventional*". (Emphasis added).

Blavette's use of a phosphorescent layer to convert electrons to photons is similar to the operation of a cathode ray tube or an image intensifier tube. Blavette uses the light spot to generate an image of the spatial position of the incident charged particle. Blavette does not describe a device which converts electrons to light for the purpose of electro-optically isolating the high voltage at the electron multiplier stage from signal output by the anodes, or to facilitate bipolar detection.

In contrast, the Applicants' claimed time-of-flight mass spectrometer as set

forth in Claim 1 includes an electron multiplier, a scintillator, and a charge collector. Although the electron multiplier and the scintillator used in the Applicants' claimed device perform the same functions as the electron multiplier (4) and the phosphorescent layer (6) of the Blavette device, the charge collector is not the same as either the anodes grid (14) or the CCD camera (24) of the Blavette device. In the Applicants' claimed arrangement, the scintillator converts the electron beam from the electron multiplier into a light beam and the light beam impinges on the charge collector. The charge collector is adapted for converting the photons in the light beam back to a plurality of electrons and for integrating the electrons into a charge pulse that corresponds to the mass of the charged particle that was incident on the electron multiplier. The Applicants' claimed arrangement, as set forth in Claim 1, electro-optically isolates the charge collector/integrator from the very high voltages associated with the electron multiplier. With the novel arrangement of the Applicants' claimed device, the potential for destruction of expensive spectrometry equipment from high-voltage power surges resulting from current source, vacuum, or other equipment failures is essentially eliminated.

The Applicants' claimed method as set forth in Claim 13 includes the steps of "collecting the multiplicity of photons, thereby electro-optically isolating the detector from a high voltage portion of the time-of-flight mass spectrometer; converting the multiplicity of photons into a second multiplicity of electrons; and then integrating the second multiplicity of electrons into a charge pulse." The device described and shown in Blavette is not capable of performing the same steps. As discussed above with reference to Claim 1, the Blavette collects the electron beam with the anodes grid (14) to determine the impact moment and thus the mass of the incident particle in a conventional manner. The anodes grid (14) is not electro-optically isolated from the electron multiplier (4). Further, the CCD camera (24) collects the light beam generated by the phosphorescent layer (6) to generate a spatial image of the incident particles. It does not convert the photons to a second electron beam and integrate the electrons in the electron beam to provide a charge pulse that corresponds to the mass of the particle.

For all of the foregoing reasons, it is believed that the Applicants' claimed apparatus as set forth in Claim 1 and the claimed method as set forth in Claim 13 are novel relative to the device described and shown in Blavette.

Claims 5 and 6 depend from Claim 1 either directly or indirectly and thus, include all of the features set forth in Claim 1. Therefore, Claims 5 and 6 are novel relative to device described in Blavette for at least the same reasons as Claim 1.

Claims 14 and 17 depend from Claim 13 either directly or indirectly and thus, include all of the steps set forth in Claim 13. Therefore, Claims 14 and 17 are novel relative to the process described in Blavette for at least the same reasons as Claim 13.

35 USC 103(a): Claims 2-4, 7-10, 15, 16, and 18-24

The Examiner rejected Claims 2-4, 7-10, 15, 16, and 18-24 under 35 USC 103(a) as being unpatentable over Blavette in view of US Patent No. 4,471,473 (Ng) and further in view of US Patent No. 5,994,694 (Frank) and US Patent No. 6,529,436 (Goodberlet). More specifically, the Examiner applied the references as follows.

Claims 2, 3, 16, and 18-20

With respect to Claims 2, 3, 16, and 18-20, the Examiner explained that Blavette discloses all of the features of those claims except for the use of a photomultiplier for converting the multiplicity of photons into a second multiplicity of electrons which are then transformed into a charge pulse. The Examiner further explained that Ng discloses a light particle image intensifier that includes a scintillator, a photocathode, and a microchannel plate which cooperate to convert a multiplicity of photons into a corresponding second multiplicity of electrons.

Ng discloses an image intensifier CCD. In the device described in Ng, high energy radiation or charged particles collide with a scintillator (14) producing photons which are converted to electrons by the photocathode (16). The few resultant photoelectrons are multiplied by the microchannel plate (20) while maintaining their spatial information. The resultant multiplicity of electrons is accelerated toward and is

collected by a CCD to produce an image.

The relevant inquiry in determining the existence of *prima facie* obviousness is whether or not the disclosures of the cited references would appear to be sufficient to one of ordinary skill in the art to suggest making the proposed substitution of combination or other modification. In the present case, it is clear that the inquiry must be answered in the negative.

The device described and shown in Ng has nothing to do with mass spectrometry, much less time-of-flight mass spectrometers. It relates to the imaging of objects that have been irradiated with an incident beam of light or atomic particles. Ng does not describe or suggest that the incident beam can be high mass ions. Nor is there any disclosure in Ng to suggest that the apparatus described therein would have any utility in mass spectrometry. Moreover, it is not readily apparent how the proposed combination would provide a charge collector disposed for receiving a multiplicity of photons from a scintillator and adapted for reconverting said photons into a second multiplicity of electrons and integrating the second multiplicity of electrons into a charge pulse corresponding to a charged particle. Further, neither reference provides any motivation for providing electro-optical isolation of a charge collector from an electron multiplier in a time-of-flight mass spectrometer. Consequently, there does not appear to be any motivation to combine the teachings of Ng with the disclosure of Blavette to make the combination proposed by the Examiner or the Applicants' claimed detector as set forth in Claim.

It is well settled that the motivation or suggestion to substitute or combine features described in disparate references must come from the references themselves. In view of the foregoing discussion, it should now be clear that the Applicants' claimed detector as set forth in Claims 2 and 3 as now presented would not have been obvious in view of Blavette and Ng when those references are considered in their entireties.

Claims 16, 17, and 20 depend from Claim 13 either directly or indirectly and thus, include of the steps set forth in that claim. Accordingly, Applicants' claimed method as set forth in Claims 16, 17, and 20 includes the following steps: collecting the

multiplicity of photons that emerge from the scintillator, converting the multiplicity of photons into a second multiplicity of electrons, and then integrating the second multiplicity of electrons in a charge pulse. With the Applicants' claimed process, the detector is electro-optically isolated from the high voltage portions of the time-of-flight mass spectrometer. As discussed above relative to Claim 13, Blavette does not describe or suggest that combination of steps. Nor does it suggest the advantage of performing those steps.

Ng describes an image intensifier that appears to operate in the following manner. A beam of light or atomic particle radiation impinges on a scintillator. The scintillator generates photons which impinge on a photocathode. The photocathode generates a plurality of electrons (photoelectrons) which are accelerated toward a microchannel plate which multiplies the number of electrons. The electrons emanating from the microchannel plate are accelerated toward an imaging device such as a photoanode, silicon diode/electron beam gun combination, or a CCD camera. The imaging device generates a signal that is further processed for display on a CRT or other display device. Ng does not describe or suggest any component or combination that performs all of the steps of Claim 13. Therefore, Ng does not provide any motivation for combining the device described therein with a device such as that described in Blavette. Moreover, as discussed above relative to Claim 2, the image intensifier described in Ng is unrelated to either the operation of the device disclosed in Blavette or to the Applicants' claimed
method which is directed to time-of-flight mass spectrometry.

For all the foregoing reasons, the Examiner's proposed combination of Blavette and Ng fails to raise a *prima facie* case of obviousness against the Applicants' claimed method as now set forth in Claims 16, 17, and 20.

Claims 4, 10, 15, and 24

In making the rejection with respect to Claims 4, 10, 15, and 24, the Examiner conceded that Blavette does not describe the use of a coating on the electron multiplier

or a metal coating on the scintillator. However, he goes on to assert that the use of such coatings is known in the art as evidenced by Frank.

The Frank patent describes a superconducting tunneling junction detector that is operated as an ion detector at cryogenic temperatures, i.e., below 2 degrees Kelvin. The Examiner cites this reference apparently because the ion detector described in Frank also utilizes some of the materials listed in Claims 4 and 15. However, the principle of operation for the Frank detector and the use of the cited materials are totally different from the Applicants' claimed bipolar time-of-flight detector.

In the Frank device, ions are collided onto a substrate containing a junction formed by sandwiching a thin insulating material between two conductors or superconductors. When the temperature is lowered sufficiently, electrons gather at the interface between the conductive and insulating interface. When a small voltage is placed across the junction, charged particles impinging upon the surface cause the electrons to jump the gap and produce charge pulses in the superconductor. The resultant charge pulses are very broad ("a few microseconds") by comparison to those produced by the Applicants' claimed detector where the charge pulses are created by free electrons ejected into the channel cavity. The Applicants' claimed detector produces charge pulses that are a thousand times **faster** than those produced by the Frank device, i.e., less than 2 nanoseconds. That is an important performance feature for a time-of-flight ion detector.

The fact that Frank lists Al_2O_3, SiO_2, diamond, and MgO, is irrelevant to the Applicants' claimed device and method. Those materials are used in the Frank device as simple insulating layers between the two conductors/superconductors forming the junction. In contrast, the Applicants' claimed detector uses the materials set forth in Claims 4 and 15 as coatings to enhance the first strike conversion efficiency of the ions on the electron multiplier. In the Applicants' claimed device and method, the listed materials are used to lower the work function of the ion converting surface which provides improved detection of larger, low energy ions because more secondary electrons are produced for each ion impact. There is no suggestion in Frank that such

materials should be used for that purpose. Nor does Frank provide any motivation to use such materials for the same purpose as the Applicants' claimed device and method because the Frank device does not use a microchannel plate electron multiplier.

For all of these reasons, it should now be clear that the proposed combination of Frank with Blavette fails to present a *prima facie* case of obviousness relative to Claims 4 and 15 of the present application.

Claims 10 and 24 are directed to the use of a metallized coating of aluminum or chromium on the incident surface of the scintillator in the Applicants' claimed detector and method. The device described and shown in Frank does not include a scintillator, much less a scintillator having a metallized coating thereon. For this reason, the proposed combination of Frank with Blavette fails to present a *prima facie* case of obviousness relative to Claims 10 and 24.

Claims 8 and 22

With respect to Claims 8 and 22, the Examiner explained that Blavette does not describe the use BICRON 418 or BICRON 422b as scintillating materials. However, he goes on to assert that the use of such materials as scintillators is known in the art as evidenced by Goodberlet.

Goodberlet describes a high density storage device utilizing an electron source, a rotating scintillator, and a photo-pick up device. In operation, data is stored in digital format by the presence or absence of a coating on the area of the rotating scintillator. If a tiny electron beam is scanned over a small predetermined pixel, a "0" is represented by covering the surface preventing the electron beam from producing photons, or a "1" is produced in the case of a non-covered area.

The Goodberlet patent does not describe an ion detector nor does it relate even remotely to the field of ion detection. The device described and shown in Goodberlet is not used in mass spectrometry, and it utilizes an electron beam as an input, not as part of the output. The device does not use an electron multiplier, but does state that the photon signal may be read out by a photodiode, Avalanche photodiode, PMT, or a

photosensitive MCP. The device described in Goodberlet does utilize a scintillator, but for an entirely different purpose. The use of a scintillator and charge collector to electro-optically isolate the output signal from the high voltage section of an ion detector and to facilitate bipolar detection is neither described nor suggested by Goodberlet.

Claim 8 depends from Claim 1 and Claim 22 depends from Claim 13. Therefore, Claim 8 includes all of the features of the Applicants' claimed detector as set forth in Claim 1 and Claim 22 includes all of the steps of the Applicants' claimed method as set forth in Claim 13. Goodberlet fails to make up the deficiencies of Blavette with respect to Claims 1 and 13 as discussed above. Therefore, regardless of whether Goodberlet describes a scintillator made of a BICRON material, the proposed combination of Goodberlet with Blavette fails to make out a *prima facie* case of obviousness relative to Claims 8 and 22.

Claims 7, 9, 21, and 23

In addressing Claims 7, 9, 21, and 23, the Examiner stated ". . . the detector where the scintillator is configured to provide a frequency bandwidth which accommodates arrival times of the multiplicity of electrons or of reflection of the photons generated within the scintillator is inherent in the process of generating photoelectrons in a scintillator, and is well known in the art." However, the Examiner did not cite any authoritative reference to substantiate his assertion of inherency. When relying upon a theory of inherency, the Examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic *necessarily* flows from the teachings of the applied prior art. *Ex parte Levy,* 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original). See also, MPEP §2112. In view of the failure of the Examiner to substantiate the basis for the assertion of inherency, this rejection cannot stand.

In any event, even if the Examiner could substantiate the assertion of inherency relative to the subject matter of Claims 7, 9, 21, and 23, the rejection would not be

sustainable. Claims 7 and 9 depend from Claim 1 and Claims 21 and 23 depend from Claim 13. Accordingly, Claims 7 and 9 include all of the features of the Applicants' claimed detector as set forth in Claim 1. Likewise, Claims 21 and 23 include all of the processing steps of the Applicants' claimed method as set forth in Claim 13. There is no reference or combination of references cited that includes all of the features of Claim 1 or all of the steps set forth in Claim 13. Therefore, Claims 7 and 9 are allowable for at least the same reasons as Claim 1 and Claims 21 and 23 are allowable for at least the same reasons as Claim 13.

CONCLUSION

It is believed that the claims of this application as now presented are in condition for allowance. Applicants respectfully request that the Examiner reconsider the rejection of the application in the light of the foregoing amendments and remarks.

Respectfully submitted,

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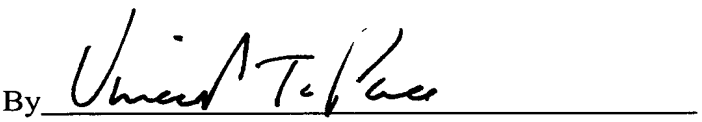
By 
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